Marine Seismic Solutions for CCS MMV

Subsurface Imaging

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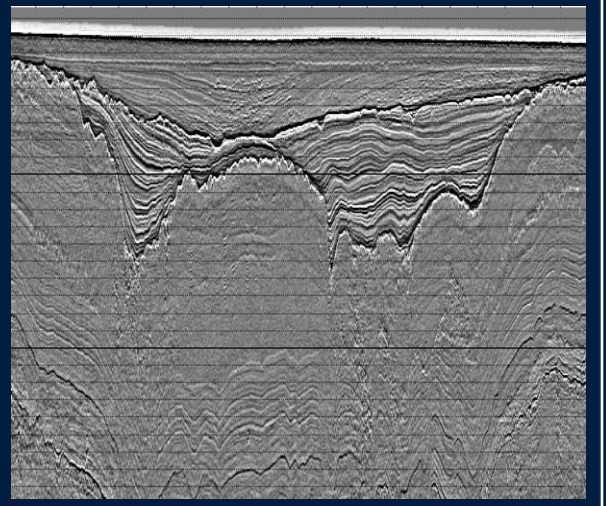
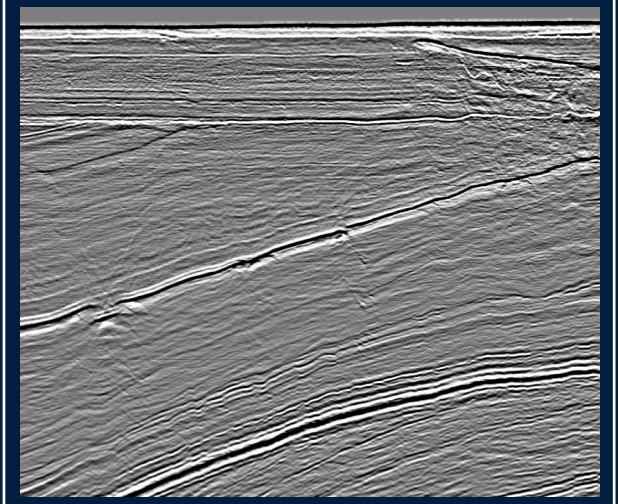
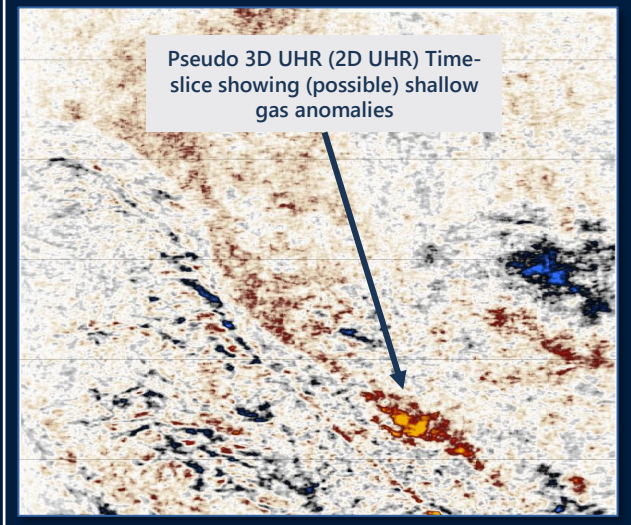
Fugro's Global Marine Seismic Solutions

Offering reliable, more efficient & tailored solutions







SeisWind 3D EHR

Penetration ~ 200 m below seabed
Resolution ≥ 30 cm at the seabed
Imaging & shallow geohazards

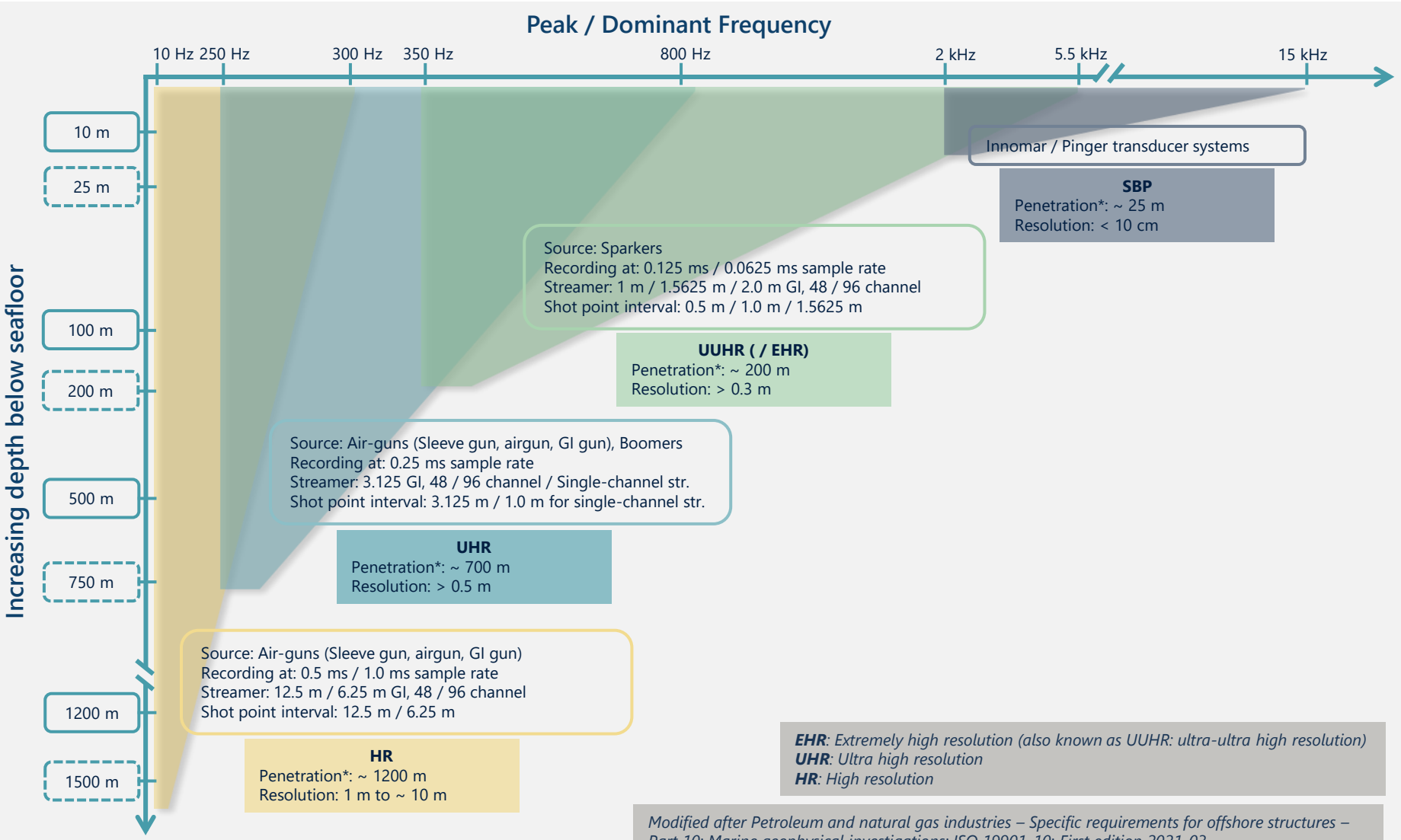
2D & 3D UHR and HR

Penetration 500 m - >1200 m below seabed
Resolution ≥ 0.5 m at the seabed
Imaging overburden, seal & shallow reservoirs

Pseudo-3D

Strong track record creating Pseudo-3D volumes from 2D data
Suitable for all water depths
Enhancing interpretation capabilities

Evolution of Seismic Resolution



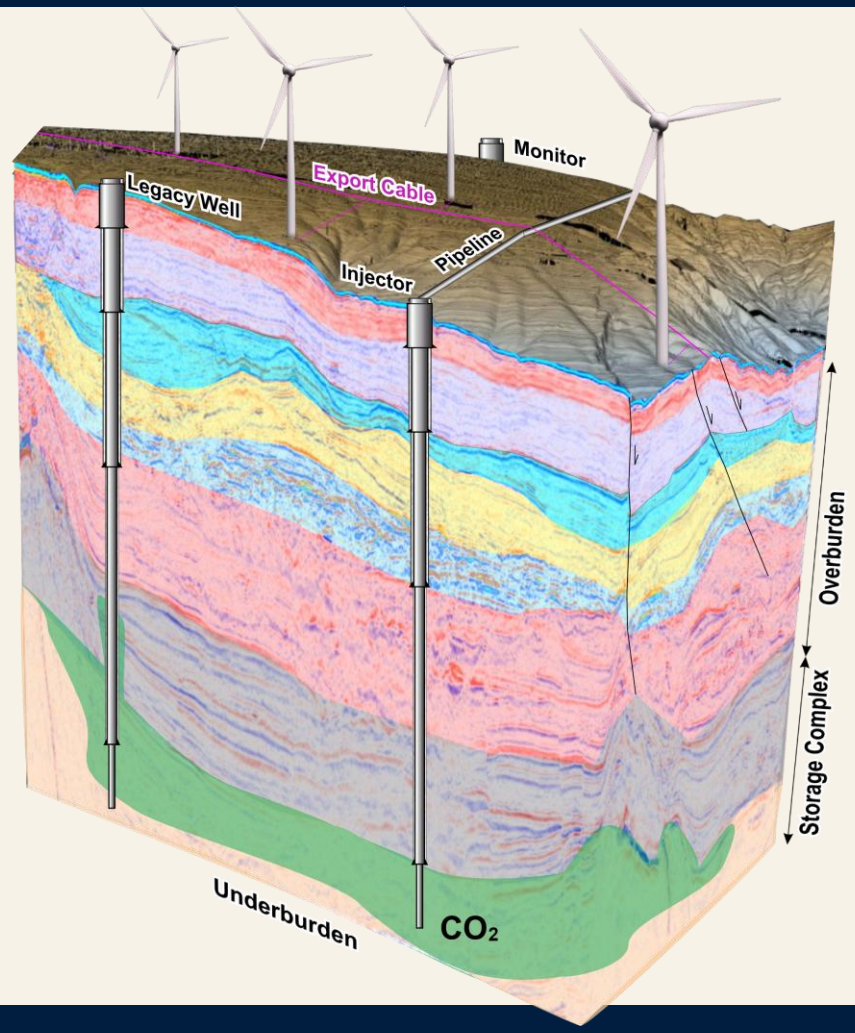
***EHR**: Extremely high resolution (also known as UUHR: ultra-ultra high resolution)*
***UHR**: Ultra high resolution*
***HR**: High resolution*

Modified after Petroleum and natural gas industries – Specific requirements for offshore structures – Part 10: Marine geophysical investigations; ISO 19901-10; First edition 2021-03
© Fugro: EAGE Marine Acquisition Workshop, Oslo 2022

** Data penetration is dependent on geology and can vary from these indicative values.*

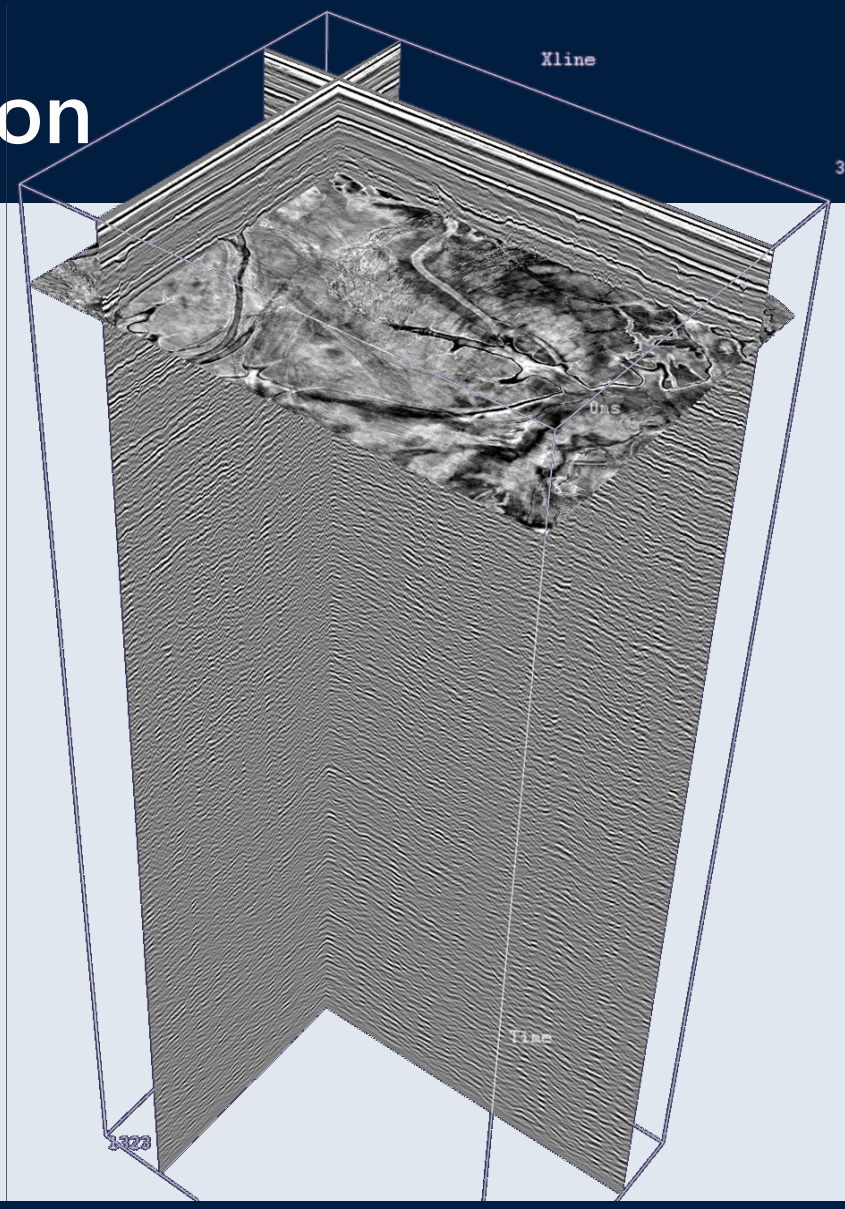
Derisking Near-Surface CO_2 Storage Roof

- **Near-surface skills**
  - Review any/all existing data
  - Defining a robust baseline
- **Near-surface resolution**
  - Acquisition – tailored geometry to optimize data resolution
  - Positioning – navigational accuracy complementing hardware
  - Imaging – bespoke data processing techniques
- **Near-surface risk mitigation**
- **Near-surface shared usage: co-location**



Imaging for Overburden Characterisation

- **2D/3D HR & UHR seismic**
  - HR seismic data – providing data penetration > 1200 m BSF
  - UHR seismic data – providing decimeter scale resolution at/near the seabed, with ~ 400 Hz dominant frequency at ~ 500 m BSF
- **2D/3D EHR seismic**
  - EHR seismic data – providing up to 150-200 m data penetration BSF with up to 2000 Hz dominant frequency at/near the seabed.
  - Avoids OWF challenges
- **Cost benefits & synergies**
  - Single vessel pass acquiring both HR & UHR datasets simultaneously, along with other geophysical sensors.
  - **Faster acquisition**: Fugro's SeisBroadview "**fully electric**" source is able to offer both HR & UHR dataset, **cutting survey time** and vessel days, and **reduced environmental impact**.



SeisBroadview

Fully electric seismic sound source that delivers clear, ultra high resolution (UHR) and high resolution (HR) images of the shallow subsurface in a single pass.

Compact system

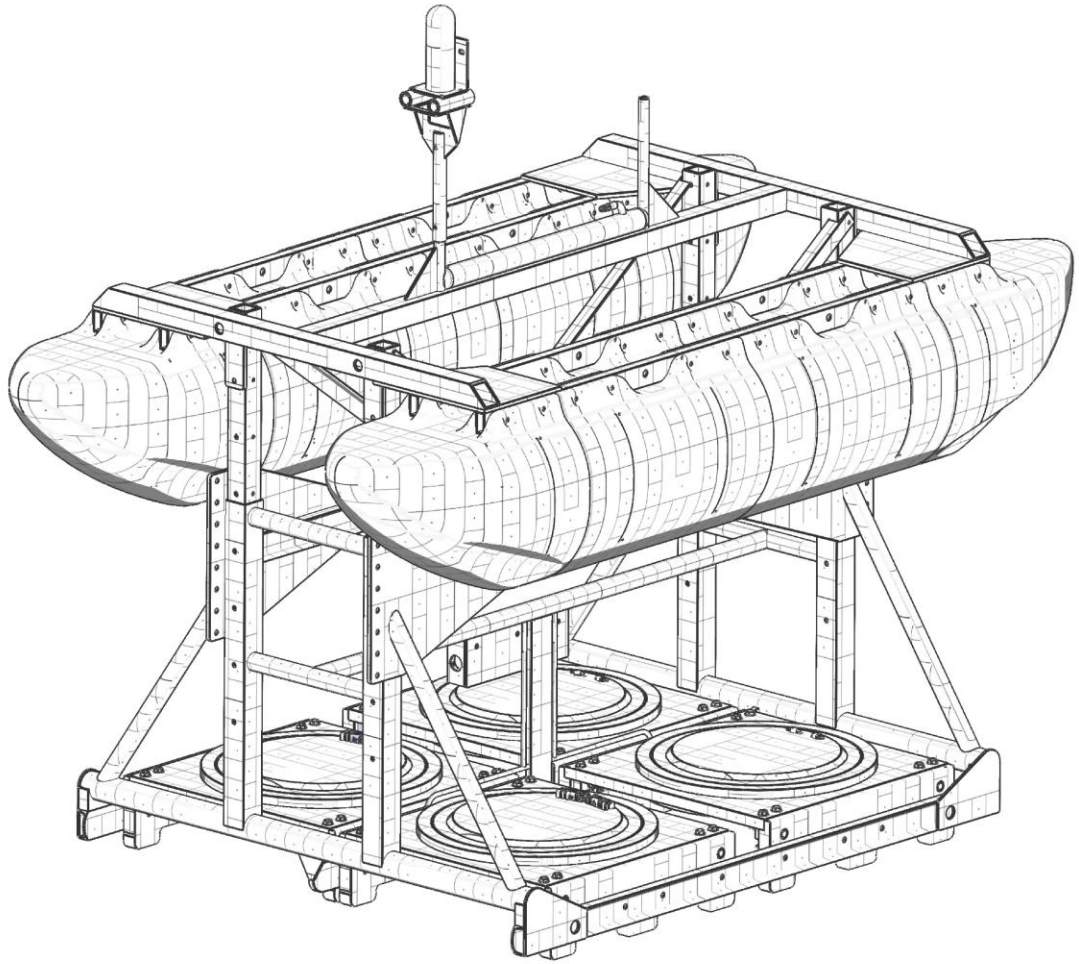
frees deck space for other operations

Broad bandwidth frequency range

provides **deep penetration** and ultra-high resolution

Air freightable system

enables **quick mobilisation**



BENEFITS

Acquire HR and UHR data in one pass

cutting survey time and vessel days

Improve crew safety

with a fully electric system and **no high-pressure equipment**

Reduce environmental impact

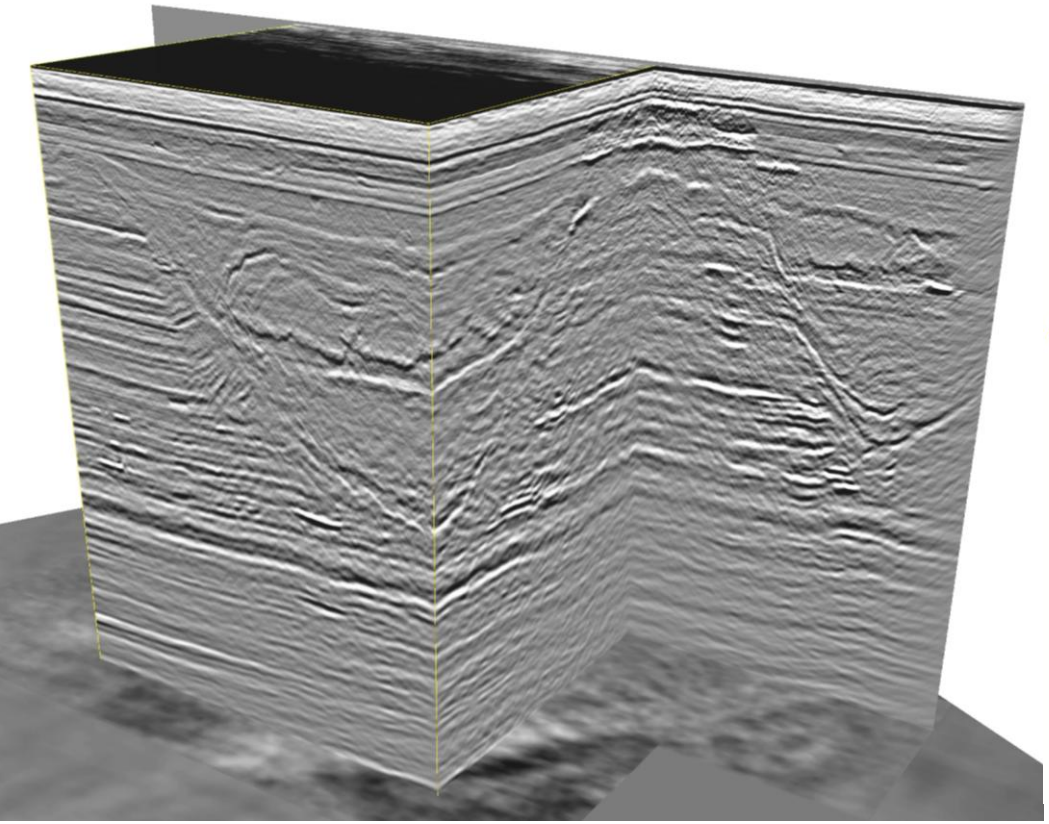
with a quieter, bubbleless source that's **easier to permit**

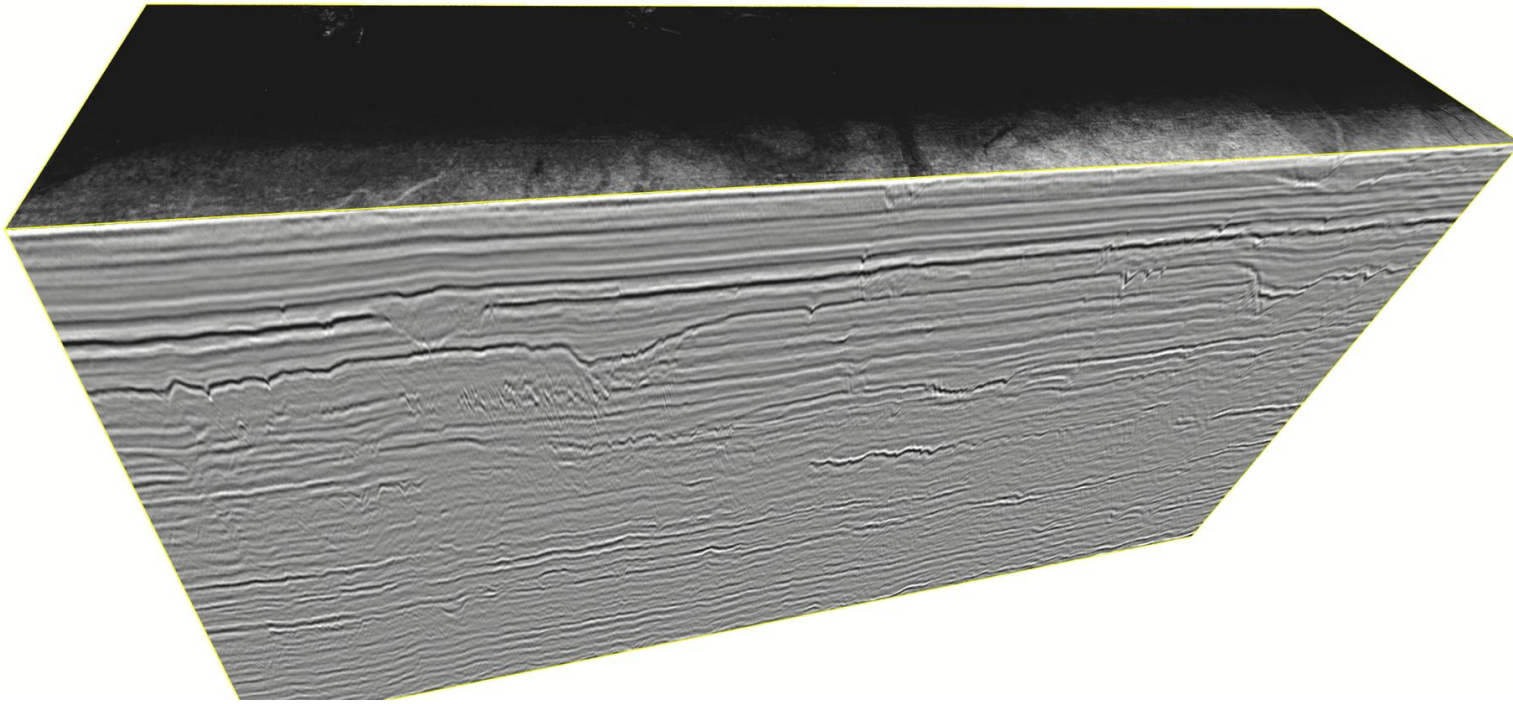
Gain consistent, repeatable data

that **accelerates interpretation** and supports confident decision-making

FUGRO

3DUHRS: Mapping Sub-surface Structures & Geohazards

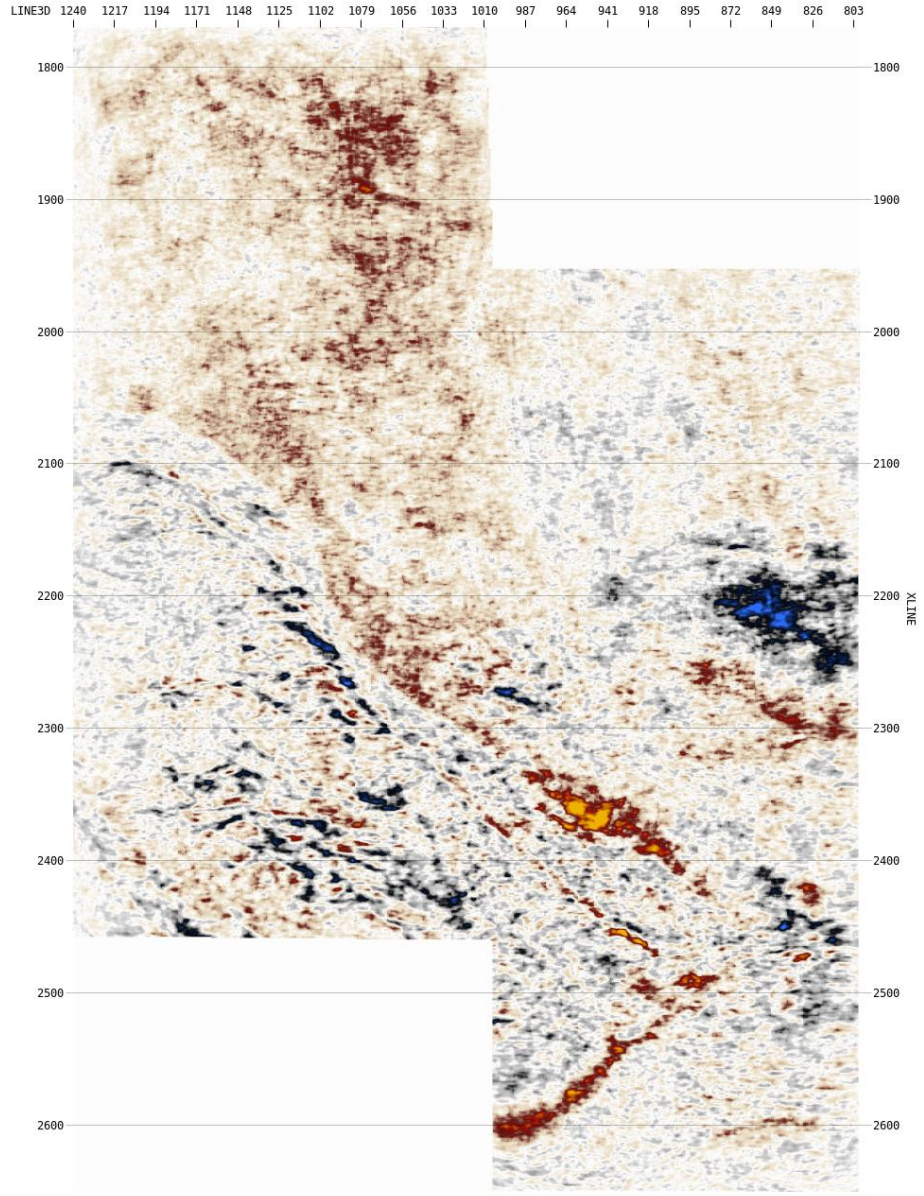




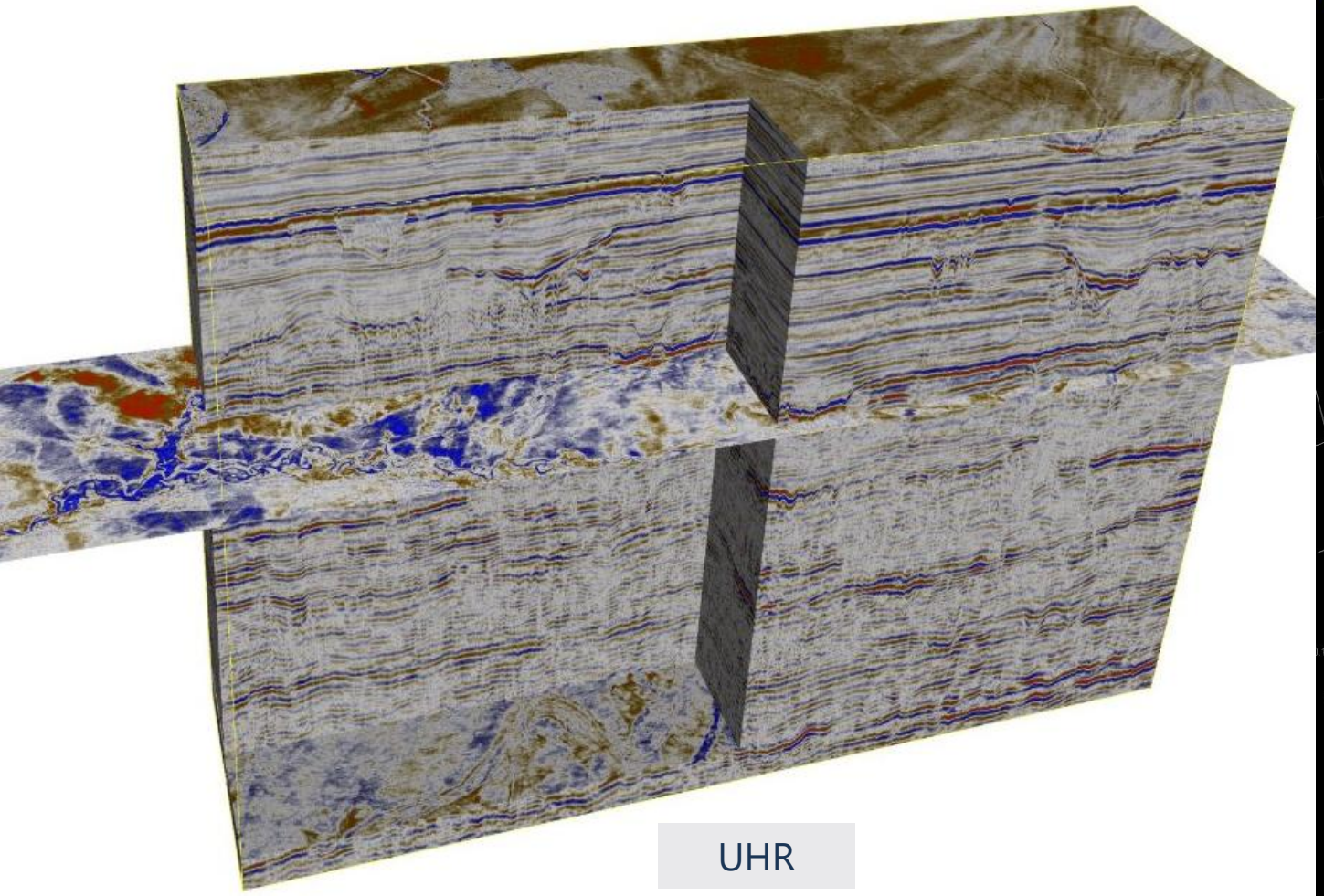
Pseudo 3DUHR, using 2DUHR Data

Alongside data example is a time-slice, extracted from a Pseudo-3D seismic data cube, generated from 2DUHR data.

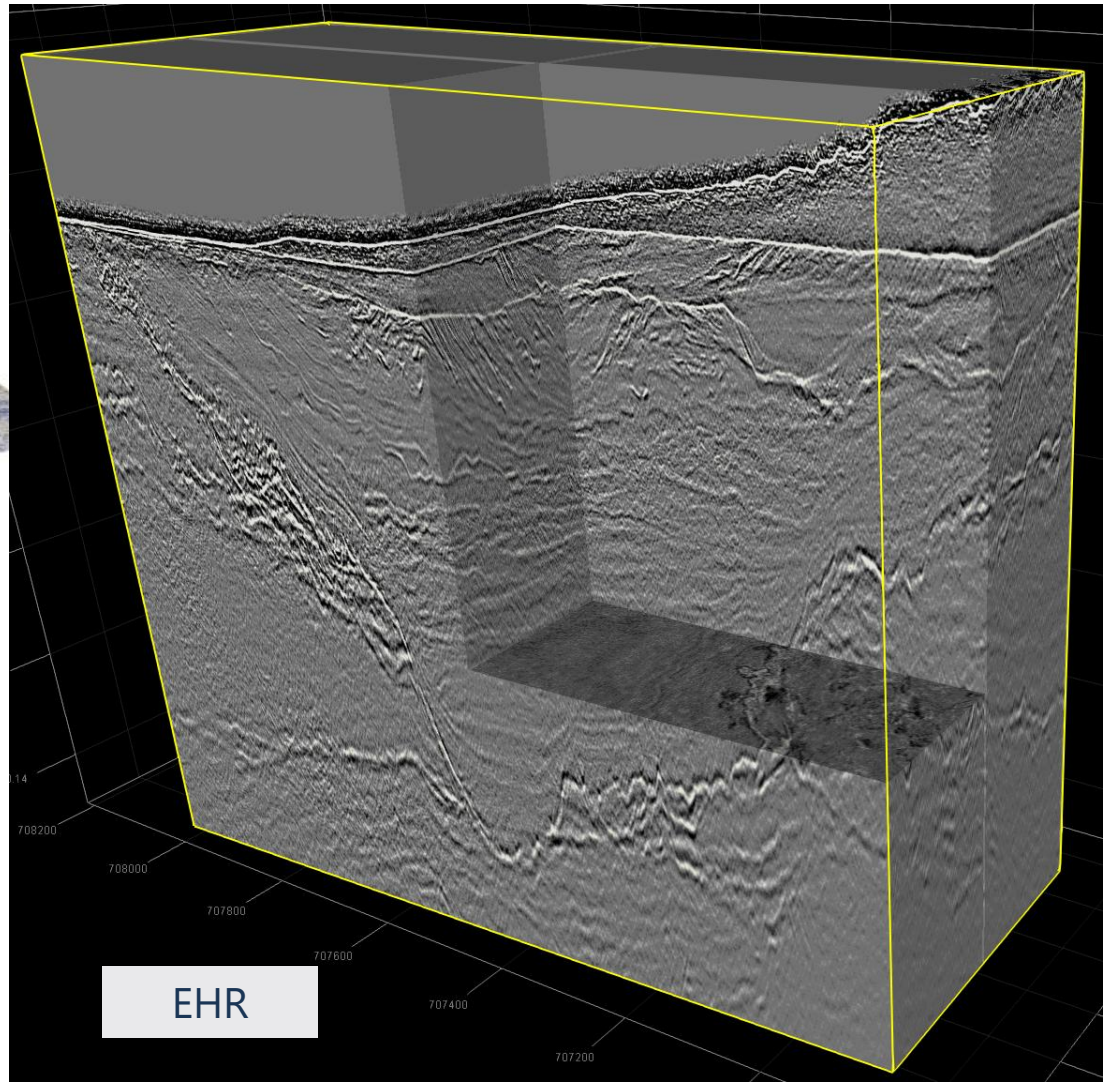
Delineating spatial continuity of events, horizons and structures is a key benefit of using Pseudo-3D.



Mapping Sub-surface Structures & Geohazards



UHR



EHR

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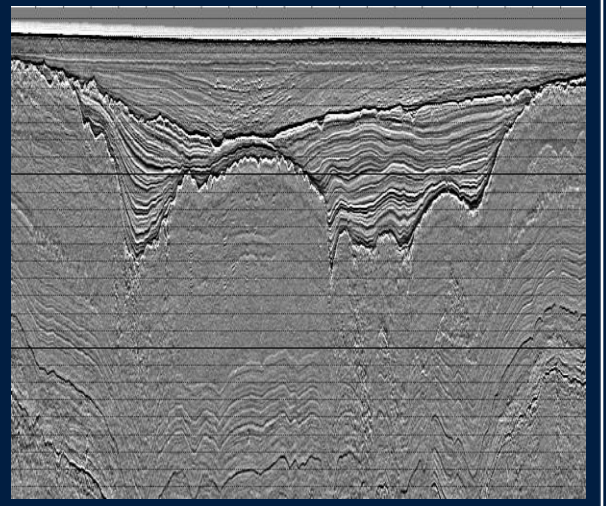

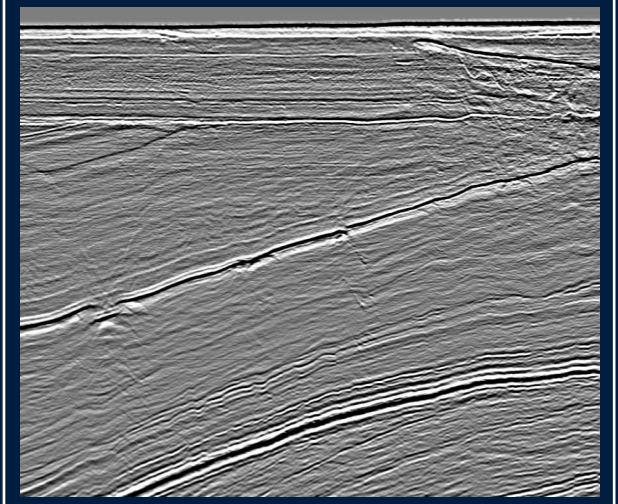

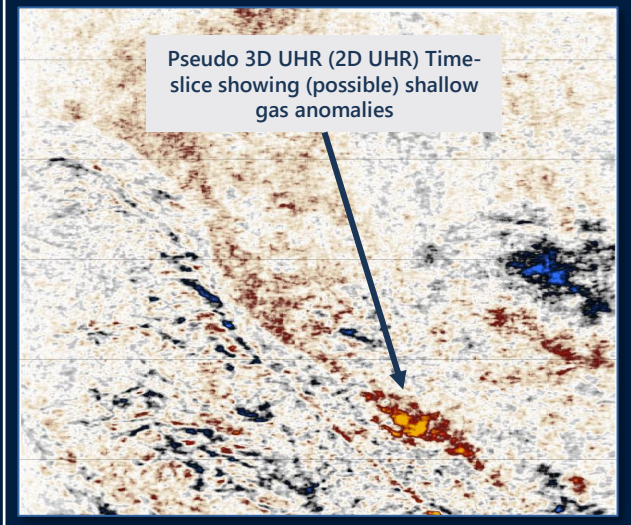

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Unlocking **Insights**
from **Geo-data**